Technical training.
Product information.

F12 Passive Safety Systems

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General information

Symbols used

The following symbol is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as the result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

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F12 Passive Safety Systems

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1. Introduction

1.1. Passive safety system

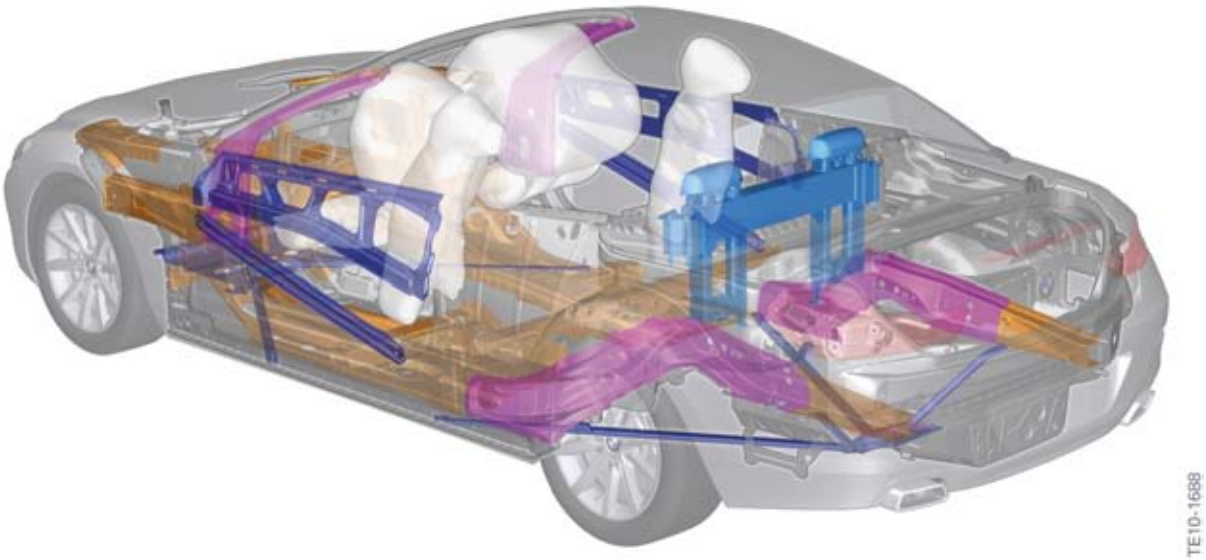
The passive safety system of the F12 is based on the objectives and characteristics of current BMW models. The passive safety system fulfils all legislative requirements worldwide.

Extensive measures were taken on the body and on the occupants safety and protection systems of the F12. In addition to the restraint system, a special body structure with a defined crash behavior is also part of the passive safety system. In the event of an accident, the forces introduced are reduced in a defined manner and therefore have less of an impact on the occupants.

The restraint systems ensure that the risk of injury is further reduced.

In the event the vehicle rolls over, the rollover protection system assists in maintaining sufficient space for the protection of the occupants.

The 4th generation Advanced Crash Safety Module (ACSM) is used as the central airbag control unit in the passive safety system for the F12.



F12 Passive safety system

F12 Passive Safety Systems

2. Models

2.1. Overview

The 4th generation passive safety system installed in the F12 is a Crash Safety Module. The following table provides a historic overview of the versions installed in previous BMW models:

Series	Model	Used as of	Version
E60	5-Series Sedan	09/2005	ACSM 1
E61	5-Series Touring	09/2005	ACSM 1
E63	6-Series Coupe	09/2005	ACSM 1
E64	6-Series convertible	09/2005	ACSM 1
E85	Z4 Roadster	01/2006	ACSM 1
E86	Z4 Coupe	05/2006	ACSM 1
E88	1-Series convertible	04/2008	ACSM 2
E70	X5 SAV	11/2006	ACSM 2
E71	X6 SAC	04/2008	ACSM 2
E93	3-Series convertible	03/2007	ACSM 2
F01	7-Series Sedan	11/2008	ACSM 3
F02	7-Series Sedan long version	11/2008	ACSM 3
F07	5-Series Gran Turismo	10/2009	ACSM 3
F10	5-Series Sedan	03/2010	ACSM 3
F25	X3 SAV	2/2011	ACSM 4
F12	6-Series convertible	03/2011	ACSM 4

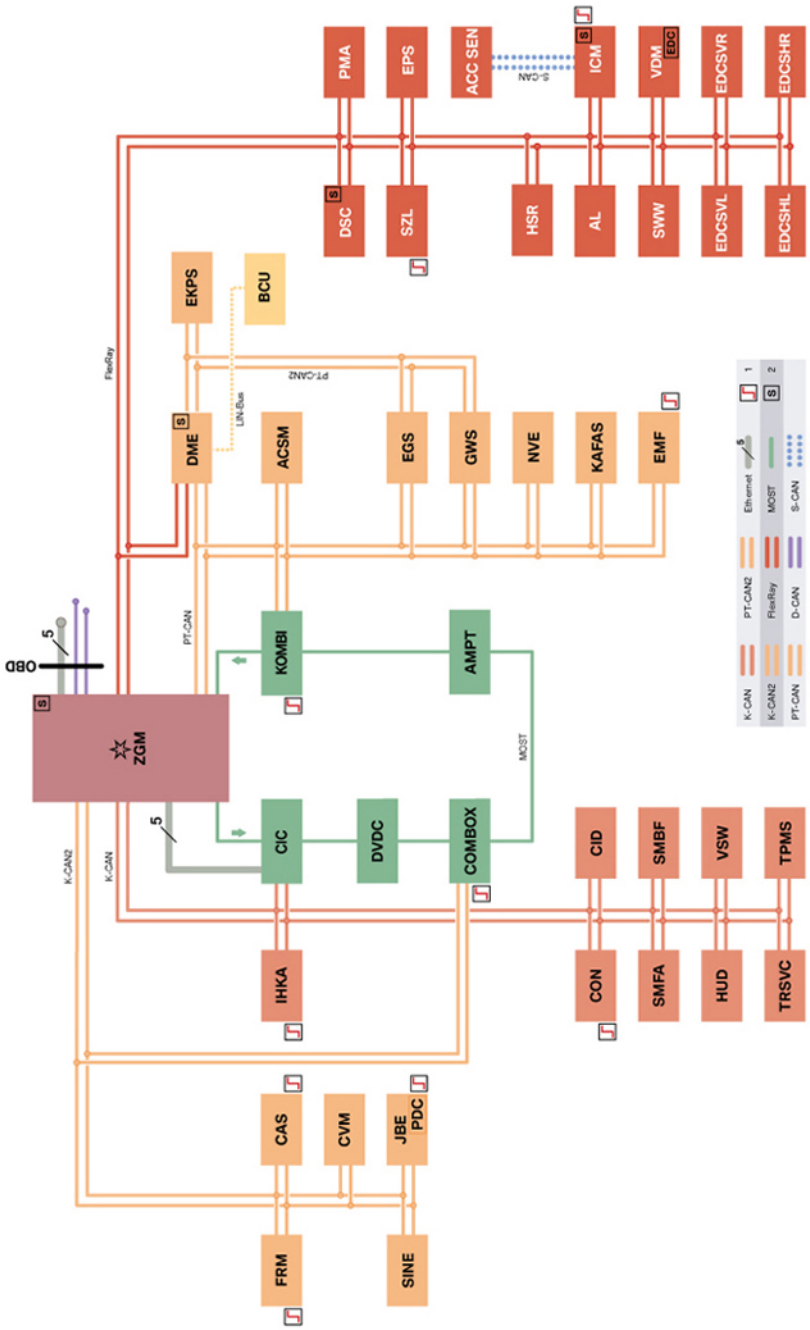
F12 Passive Safety Systems

3. System overview

3.1. System wiring diagrams

The following bus overview shows the vehicle circuit structure of the F12 and incorporation of the modules on the powertrain CAN.

3.1.1. Bus overview



F12 Bus overview

F12 Passive Safety Systems

3. System overview

Index	Explanation
1	Control units with wake-up authorization
2	Start-up node control units for starting up and synchronizing the FlexRay bus system
ACC-SEN	Active Cruise Control Sensor
ACSM	Advanced Crash Safety Module
AL	Active steering
AMPT	Top HiFi amplifier
BCU	Battery Charge Unit (for auxiliary battery only w/IAC)
CAS	Car Access System
CID	Central information display
COMBOX	Combox (Combox multimedia, Combox multimedia with telematics)
CON	Controller
CVM	Convertible top module
DME	Digital Motor Electronics
DSC	Dynamic Stability Control
DVDC	DVD changer
EDCSHL	Electronic Damper Control satellite, rear left
EDCSHR	Electronic Damper Control satellite, rear right
EDCSVL	Electronic Damper Control satellite, front left
EDCSVR	Electronic Damper Control satellite, front right
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EMF	Electromechanical parking brake
EPS	Electronic power steering (electromechanical power steering)
FRM	Footwell module
GWS	Gear selector switch
HEADUNIT	Headunit (car information computer or car information computer basic II)
HSR	Rear axle slip angle control
HUD	Head-Up Display
ICM	Integrated Chassis Management
IHKA	Automatic integrated heating and A/C control unit
JBE	Junction box electronics
KAFAS	Camera-based driver support systems
KOMBI	Instrument panel
NVE	Night vision electronics

F12 Passive Safety Systems

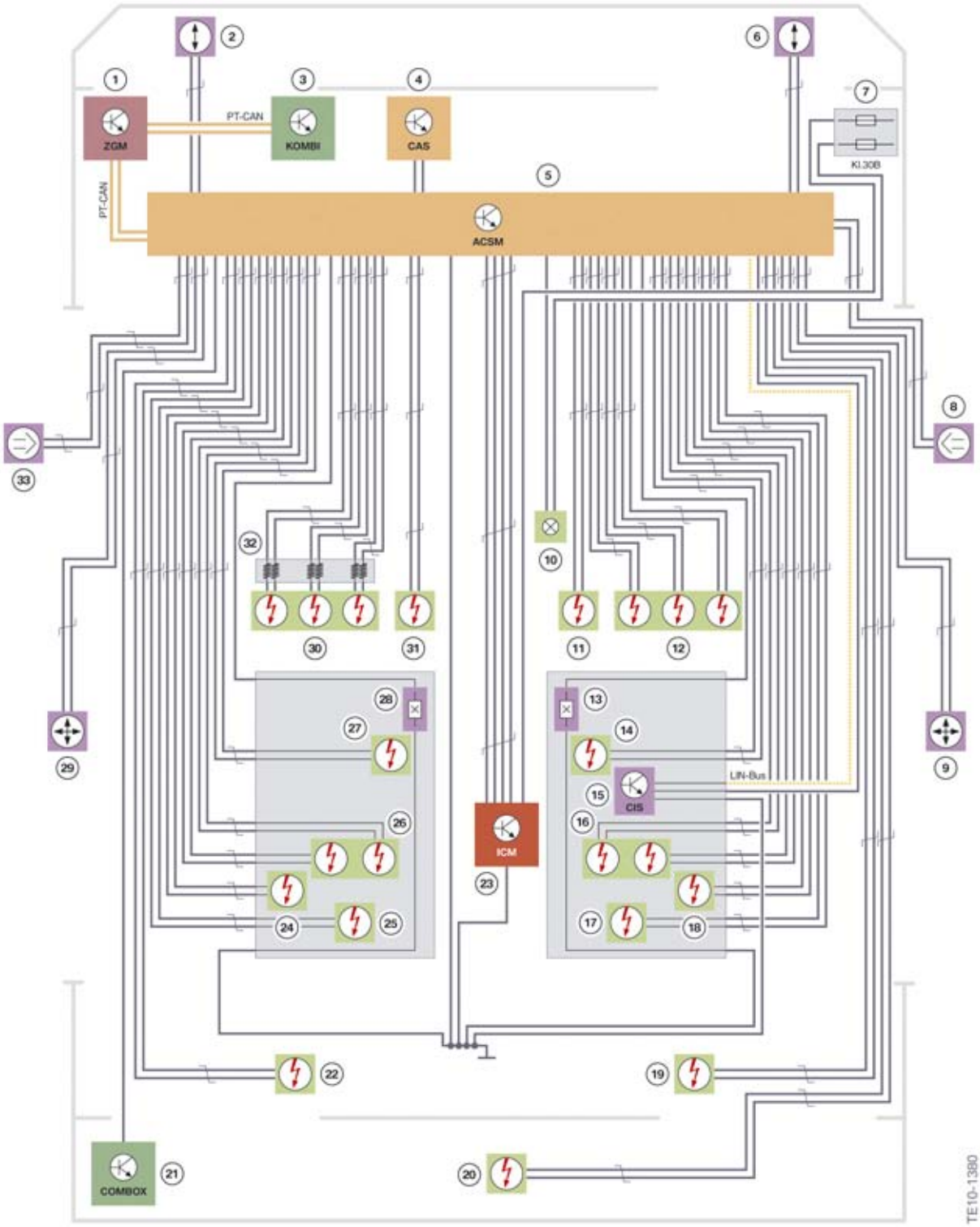
3. System overview

Index	Explanation
PDC	Park Distance Control
PMA	Parking manoeuvring assistant
TPMS	Tire Pressure Monitor System
SINE	Siren with tilt alarm sensor
SMBF	Front passenger seat module
SMFA	Driver's seat module
SWW	Blind Spot Detection (Lane change warning)
SZL	Steering column switch cluster
TRSVC	Control unit for camera systems
VDM	Vertical Dynamics Management
VSW	Video switch
ZGM	Central gateway module

F12 Passive Safety Systems

3. System overview

3.1.2. System wiring diagram



F12 System wiring diagram

F12 Passive Safety Systems

3. System overview

Index	Explanation
1	Central gateway module
2	Front sensor, left engine support
3	Instrument panel
4	Car Access System
5	Crash Safety Module
6	Front sensor, right engine support
7	Terminal 30B
8	Airbag sensor, door, right (pressure)
9	Acceleration sensor, B-pillar on right
10	Indicator lamp for front passenger airbag deactivation
11	Knee airbag, front passenger
12	Front passenger airbag, two-stage with ventilation
13	Seat belt buckle contact, front passenger
14	Seat belt buckle tensioner, front passenger
15	Seat occupancy mat, CIS mat
16	Automatic tensioner with adaptive force limiter, front passenger
17	Crash-active headrest, front passenger
18	Side head airbag, front passenger
19	Roll-over protection system, right
20	Safety battery terminal
21	COMBOX
22	Roll-over protection system, left
23	Integrated Chassis Management
24	Side head airbag, driver
25	Crash-active headrest, driver
26	Automatic tensioner with adaptive force limiter, driver
27	Seat belt buckle tensioner, front passenger
28	Seat belt buckle contact, driver
29	Acceleration sensor, B-pillar on left
30	Driver's airbag, two-stage with ventilation
31	Knee airbag, driver
32	Clock spring
33	Airbag sensor, door, left (pressure)

F12 Passive Safety Systems

4. Functions

4.1. Functions of Crash Safety Module

The function of the Crash Safety Module is to permanently evaluate all sensor signals in order to identify a crash situation. As a result of the sensor signals and their evaluation, the Crash Safety Module identifies the direction of the crash and the severity of the impact.

In addition, information on the seat occupancy of the front passenger seat and whether or not the driver's and/or front passenger's seat belt is fastened is used as input.

The ACSM evaluates the information from the sensors then forwards corresponding measures for selective activation of the necessary restraint systems.

The Crash Safety Module monitors the system itself and indicates when it is ready for operation by switching off the airbag indicator light.

If a fault develops during operation this is stored in an event memory and can be read out for diagnosis purposes.

If a crash situation is detected, a crash message is sent to the other bus users in the data bus network as notification. The relevant control units respond to this signal by executing their own activities according to the severity of the crash.

The activities include:

- Unlocking the central locking system
- Activating the hazard warning flasher
- Switching on the interior light
- Deactivating the fuel pump
- Automatic emergency call.

An additional function of the Crash Safety Module is the acoustic seat belt warning that reminds the driver and front passenger using visual and acoustic signals to fasten their seat belts.

The functions of the Crash Safety Module are generally divided into the following areas:

- Crash-relevant functions
- System monitoring functions
- Additional convenience functions.

4.2. Crash-relevant functions

The Crash Safety Module must fulfil the following crash-relevant functions:

- Evaluating the sensor signals
- Crash detection
- Specifying the trigger time and trigger sequence
- Triggering the ignition circuit output stages

- Sending the crash message to all bus users
- Crash documentation
- Emergency call function.

4.2.1. Evaluating the sensor signals

The sensors serve to identify and verify head-on, side impact and rear-end collisions while also offering roll-over detection.

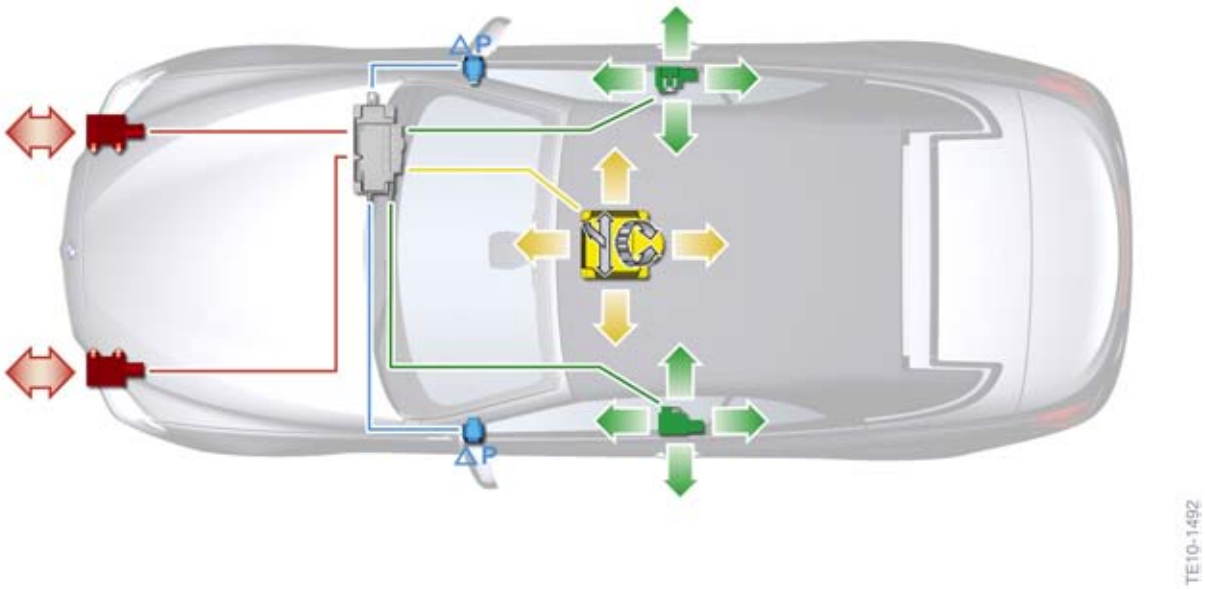
The sensors are directly connected to the Crash Safety Module where their signals are evaluated and processed.

4.2.2. Crash detection

The F12 is equipped with the following sensors:

- One lateral and one longitudinal acceleration sensor in the B-pillars (green)
- One airbag sensor to monitor the pressure in each of the front doors (blue)
- One lateral and one longitudinal acceleration sensor in the ICM (yellow)
- One roll rate sensor in the ICM (yellow)
- One vertical acceleration sensor in the ICM (yellow)
- One up front sensor on each of the engine supports (red).

The up front sensors on the engine supports assist with the identification of a head-on collision and the corresponding severity.



F12 Sensors ACSM

4.2.3. Trigger time and trigger sequence

The Crash Safety Module uses the values transmitted by the sensors to determine the direction and severity of the crash.

In the event of a head-on collision, corresponding high acceleration values from the longitudinal acceleration sensors in the B-pillar and ICM respectively must be detected. For example: An algorithm uses the acceleration values to calculate the severity and direction of the crash. This information is used to assist in the calculation of the trigger times and sequence in which the restraint systems are activated.

A possible imminent rollover is also detected in this way so the appropriate protection systems are energized.

4.2.4. Activation of the ignition circuit output stages

The Crash Safety Module is supplied by the Car Access System 4 (CAS 4) via the terminal 30B. The Crash Safety Module is in offline mode with terminal 30B. This means that it is active on the data bus and can perform all diagnostic functions. Triggering of the ignition circuits is blocked and is only enabled as of terminal 15 once the system self-test is complete. The Crash Safety Module is also ready for ignition, even with the logical terminal R after engine off.

The ignition capacitors are recharged via a switching controller. These ignition capacitors make the firing energy available in the event of a collision. If the voltage supply is interrupted during a crash, the ignition capacitors serve briefly as an energy reserve.

The ignition circuit output stages consist of a high-side and a low-side power switch. The high-side power switch connects the ignition voltage, while the low-side power switch connects to the ground. The ignition circuit output stages are controlled by a microcontroller.

The high-side and low-side power switches also serve to check the ignition circuits during the system self-test.

4.2.5. Sending the crash message

In the event of a collision involving activation of the restraint systems, the Crash Safety Module sends a crash message to the bus users in the bus-system network. In tandem with this, the Combox is prompted to send an emergency call via a direct single-wire connection.

As a result, the respective control units perform the following functions depending on the crash severity:

Function	Control unit
Switch off electric fuel pump	Digital Motor Electronics (DME) or via electronic fuel pump control (EKPS)
Switch off the auxiliary heater (Not US)	Automatic integrated heating and A/C control unit (IHKA)
Unlock central locking system	Junction box electronics (JBE)
Switch on hazard warning flashers	Footwell module (FRM)
Switch on interior light	Footwell module (FRM)
Transmit emergency call	Combox

4.2.6. Crash documentation

In the event of a collision where one or more actuators are activated, a crash entry is stored in a non-erasable memory. After three crash entries, a non-erasable fault entry is stored in the fault memory together with the information that the three crash messages have been saved. The airbag indicator light also lights up continuously.

The three crash entries could also be stored during the course of an accident. Each crash entry is assigned a system time. The control unit remains capable of firing even after three crash entries. The crash entries cannot be erased and serve the purpose of subsequent device diagnosis. A maximum of three crash entries can be stored. The control unit must then be replaced.

4.2.7. Emergency call function

An emergency call function is always available for the F12. Furthermore, the customer has the option of activating a breakdown call. Irrespective of whether the customer orders a telephone, each vehicle is equipped with a Combox, a telematics antenna, an emergency antenna, a hands-free system and a GPS antenna for determining the location.

Manual emergency call

Drivers who are not directly involved in the accident can use the manual emergency call to request assistance.

The emergency call button is located in the roof function center and is connected to the Combox directly.

Voice contact with the service provider is established by pressing the emergency call button. The voice contact is indicated by a flashing LED in the switch.

Automatic emergency call

The Crash Safety Module sends a message to the Combox in the event of an accident with corresponding crash severity. The Combox sends an emergency call, and also the location of the vehicle if available.

Attempts are made at the same time to establish a voice contact with the occupants of the vehicle in order to obtain more detailed verbal information about the accident (e.g. condition of occupants). Further rescue operations can be initiated accordingly.

Advanced Automatic Crash Notification

In addition, the Advanced Automatic Crash Notification function features in vehicles with BMW Assist.

When the emergency call is made, data from various sensors is transmitted to the call center. This sensor data is evaluated in order to determine the probability of injury risk.

The emergency call contains additional specific information on the circumstances of the accident. This means that more precise information regarding the accident and risk of injury is therefore available at the call center and can be forwarded to the emergency coordination center. The emergency coordination center can then initiate appropriate measures.

4.3. System monitoring functions

The Crash Safety Module has the following system monitoring functions:

- System self-test (pre-drive check)
- Display system functionality
- Cyclic monitoring
- Fault display and fault storage
- Output of faults (diagnosis)
- Acoustic and visual seat belt warning
- Deactivation of the front passenger airbag, front passenger knee airbag and side airbag on the front passenger side

4.3.1. System self test

The Crash Safety Module performs a system self test from terminal 15. The airbag indicator light is energized for roughly five seconds during the system self test.

Once the system self test is complete and no faults have been identified, the airbag indicator light goes out and the system is ready to operate.

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4. Functions

4.3.2. Display system functionality

The airbag indicator light in the instrument panel goes out to indicate that the Crash Safety Module is ready for operation.

4.3.3. Cyclic monitoring

Once the system self-test has been successfully concluded and the system is ready for operation, a cyclic monitoring procedure is performed for fault monitoring purposes. This cyclical monitoring serves the internal diagnosis of the control unit and overall airbag system. Cyclical monitoring takes place continuously from terminal 15. This also continues when logical terminal R is reached after the engine is switched off.

4.3.4. Fault display and fault storage

The Crash Safety Module has a non-volatile event memory. The airbag indicator light lights up to indicate a fault entry.

Events, such as the activation of an airbag or belt tensioner, are also stored in the fault memory.

If the event memory contains the entry that the restraint system has been activated, this only means that the restraint system has been ignited and is therefore not available for further activation and not that it malfunctioned during the crash.

4.3.5. Output of faults (diagnosis)

The fault memory can be read out via the diagnostic interface with the assistance of the Integrated Service Technical Application (ISTA) in the BMW diagnosis system. After rectifying the faults or after replacing activated components, the fault memory can be cleared with the "Clear fault memory" diagnosis command.

4.3.6. Acoustic and visual seat belt warning

An acoustic and visual seat belt warning is a standard feature of all vehicles equipped with the Crash Safety Module. The Crash Safety Module records whether or not the driver or front passenger have fastened their seat belts. If they have not, an acoustic and visual warning is output to remind them to fasten their seat belts. Both seat belt buckle switches are monitored separately.

4.3.7. Deactivating the airbag

The airbag can be deactivated automatically in order to comply with the National Highway Traffic Safety Administration (NHTSA) regulations. When the child seats listed in the regulation are occupied by a child this must lead to deactivation of the airbag.

To do so, a seat occupancy mat is used on the front passenger seat for the purpose of occupancy detection and classification of occupants in the front passenger seat. A further development of the Occupant Classification 3 mat (OC3 mat), the Capacitive Interior Sensing mat (CIS mat), is used in the F12.

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4. Functions

The CIS mat comprises two elements: a sensor wire that runs parallel to the seat heating in the seat cushion and an evaluation unit. The CIS mat measures the capacity and ohmic resistance between the sensor wire (anode) and the vehicle ground (cathode) at a frequency of 120 kHz. The CIS mat determines from the change in capacity and resistance whether the front passenger seat is occupied by an adult or a child in a child seat.

Measuring procedure used by CIS mat

Deactivation of the front passenger airbag, the front passenger knee airbag and side head airbag on the front passenger side is signalled by the indicator lamp for front passenger airbag deactivation.

The indicator lamp for front passenger airbag deactivation in the roof function center lights up if a child seat with child (e.g. a child restraint system that has been tested in accordance with the NHTSA regulations and is holding a small child is detected on the front passenger seat) or if the front passenger seat is unoccupied.

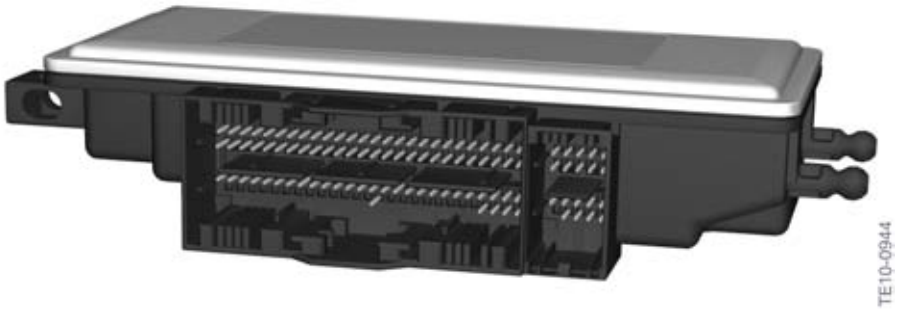
The display brightness is controlled by automatic regulation of the display illumination.

F12 Passive Safety Systems

5. System components

5.1. Crash Safety Module

The Crash Safety Module is assembled in a housing with three sockets.



F12 Crash Safety Module

The Crash Safety Module is located behind the glove box as it was no longer possible to accommodate it centrally on the transmission tunnel due to the size of the Crash Safety Module and wiring harness connection.

The Crash Safety Module also contains the output stages for the rollover protection bar, which means the rollover controller is no longer required.

The Crash Safety Module no longer contains any sensors. The sensors are located in the ICM which is mounted on the transmission tunnel.

5.2. Sensors and switches

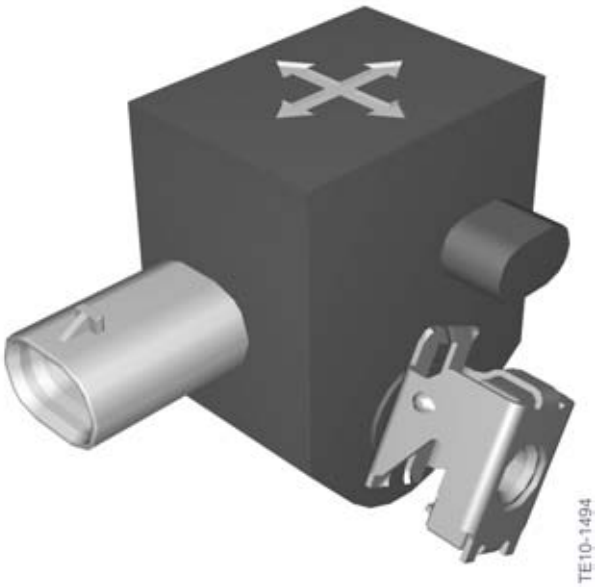
The following sensors and switches are installed:

- Lateral and longitudinal acceleration sensors are in the ICM
- Roll rate sensor is in the ICM
- Vertical acceleration sensor is in the ICM
- Lateral and longitudinal acceleration sensors are on the B-pillars
- One airbag sensor is located in each door (pressure)
- One front sensor is located on each of the engine supports
- CIS mat with occupant classification
- Seat belt buckle switch for the driver and front passenger
- Emergency call button

5.2.1. Lateral and longitudinal acceleration sensor, B-pillar

The lateral and longitudinal acceleration sensors in the B-pillars assist with the identification of head-on, side and rear-end collisions.

The B-pillar airbag sensor consists of a longitudinal acceleration sensor and a lateral acceleration sensor. The acceleration sensors measure both the acceleration and the deceleration in the X and Y directions. The resultant from the X and Y signals is decisive in identifying the direction of the crash. The airbag sensors in the B-pillar assist with the identification of head-on, side and rear-end collisions. The B-pillar airbag sensors on the left and right are of identical design and are allocated by way of mechanical coding during installation.



F12 Lateral and longitudinal acceleration sensor, B-pillar

5.2.2. Door airbag sensor (pressure)

Side impacts are identified with the assistance of the airbag sensors. In addition to the high lateral acceleration values that are present, the pressure in the door cavity also increases in the event of a side impact.

The airbag sensors in the doors serve to verify the plausibility of the acceleration signals from the B-pillar airbag sensors and the ICM when a side impact is detected. The airbag sensors are situated in the inner panel of the doors and measure the increase in pressure in the event of a side collision. In the event of a side collision with the door, the outer panel is pressed inward, thus reducing the volume and increasing the pressure in the door interior. This pressure change is measured by the airbag sensors. The airbag sensor also includes electronics, in addition to the pressure sensor, that digitize the pressure readings and transmit them cyclically to the Crash Safety Module. The data is transferred in the same way as the B-pillar airbag sensors. The pressure readings are evaluated in the Crash Safety Module.

F12 Passive Safety Systems

5. System components

F12 Airbag sensor, door (pressure)

5.2.3. Front sensor

Two front sensors are installed in the front area of the engine support. The measured values are forwarded to the Crash Safety Module where they are evaluated.

The sensors in the front area of the side member on the left and right assist with identification of a head-on collision.

They deliver additional information to the crash safety module on the characteristics and severity of the collision. Each sensor contains an acceleration sensor for recording the deceleration, signal processing technology and an ASIC for data transfer. The measured values are sent in the form of a data telegram to the crash safety module and are used in the calculation of the algorithm.

F12 Front sensor, engine support

5.2.4. Sensors in the ICM

The ICM control unit is located centrally on the transmission tunnel. In addition to the driving dynamics control sensors, the ICM in the F12 also incorporates longitudinal and lateral acceleration sensors for crash detection plus a roll rate sensor and vertical acceleration sensor for roll-over detection. The sensors in the ICM of F12 replace the central sensor that was used with the ACSM 3.

In order for the ICM to be able to transmit the sensor data directly to the ACSM 4, it is connected to the latter via four lines. The transmitted data is evaluated in the ACSM 4.

The sensor data of the ICM helps the ACSM 4 identify side or head-on crashes and assists with roll-over detection.

F12 ICM

F12 Passive Safety Systems

5. System components

5.2.5. CIS mat

The capacitive interior sensing mat (CIS mat) is fitted in the front passenger seat instead of the seat occupancy mat. The CIS mat can detect whether the front passenger seat is occupied by an adult or a child in a child seat. The indicator lamp for front passenger airbag deactivation lights up to signal deactivation of the front passenger front and side head airbags.

5.2.6. Seat belt buckle switch

The seat belt buckle switches are located in the seat belt buckles of the driver and front passenger seat.

The seat belt buckle switch detects whether the seat belt buckle tongue is in the seat belt buckle. The Crash Safety Module supplies power to the sensors and performs the evaluation.

From terminal 15, the seat belt buckle switch is permanently monitored and used for the visual and acoustic seat belt warning and also to determine which restraint systems are triggered.

F12 Seat belt buckle switch

5.3. Actuators

The following actuators are installed in the F12:

- Two-stage driver's airbag with active vent valve
- Two-stage driver's airbag with active vent valve
- Knee airbag on left and right
- Side head airbag on front left and right
- Roll-over protection system on left and right
- Seat belt buckle tensioner on front left and right

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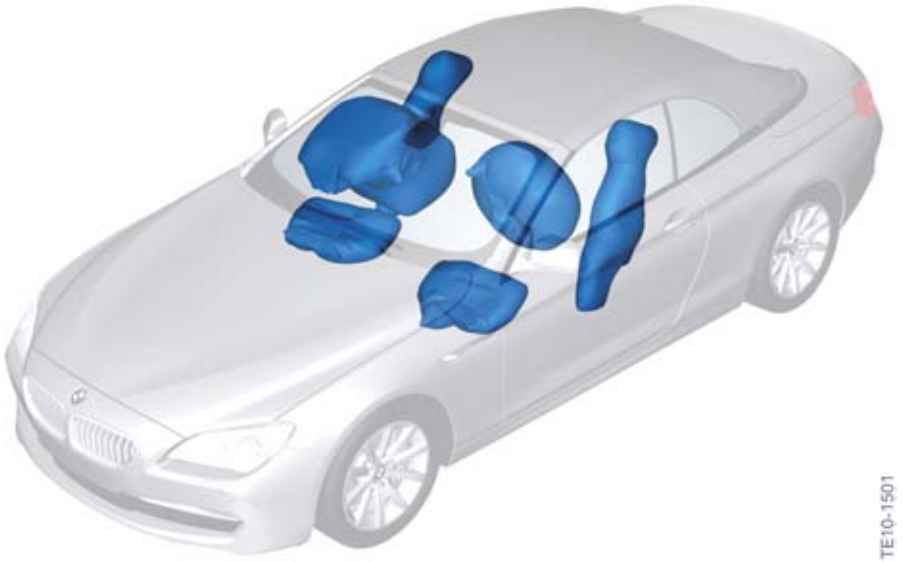
5. System components

- Automatic tensioner with adaptive force limiter
- Crash-active headrests on front left and right
- Safety battery terminal.

In addition, the following indicator lights inform the vehicle occupants about the condition of the safety systems:

- Airbag indicator light
- Seat belt warning light
- Indicator lamp for front passenger airbag deactivation.

The following graphic shows the airbags in the activated state. Depending on the type of impact, only specific airbags are activated.



F12 Airbags

5.3.1. Driver's airbag

The purpose of the driver's airbag is to reduce the risk of injury to the driver in combination with the seat belt when a head-on collision occurs. The driver's airbag is located in the steering wheel.

F12 Passive Safety Systems

5. System components

F12 Steering wheel with driver's airbag

A two-stage generator is installed which can be used to activate the stages at different times, depending on the severity of the crash detected.

F12 Driver's airbag in steering wheel, shown without airbag

Index	Explanation
1	Gas generator with exhaust vents
2	Actuator for vent valve

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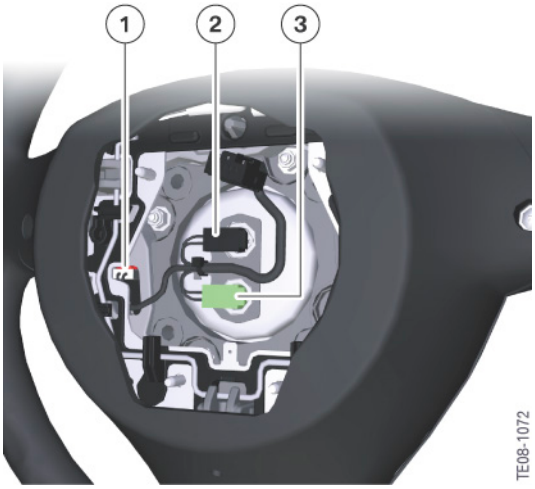
5. System components



F12 Rear view of driver's airbag

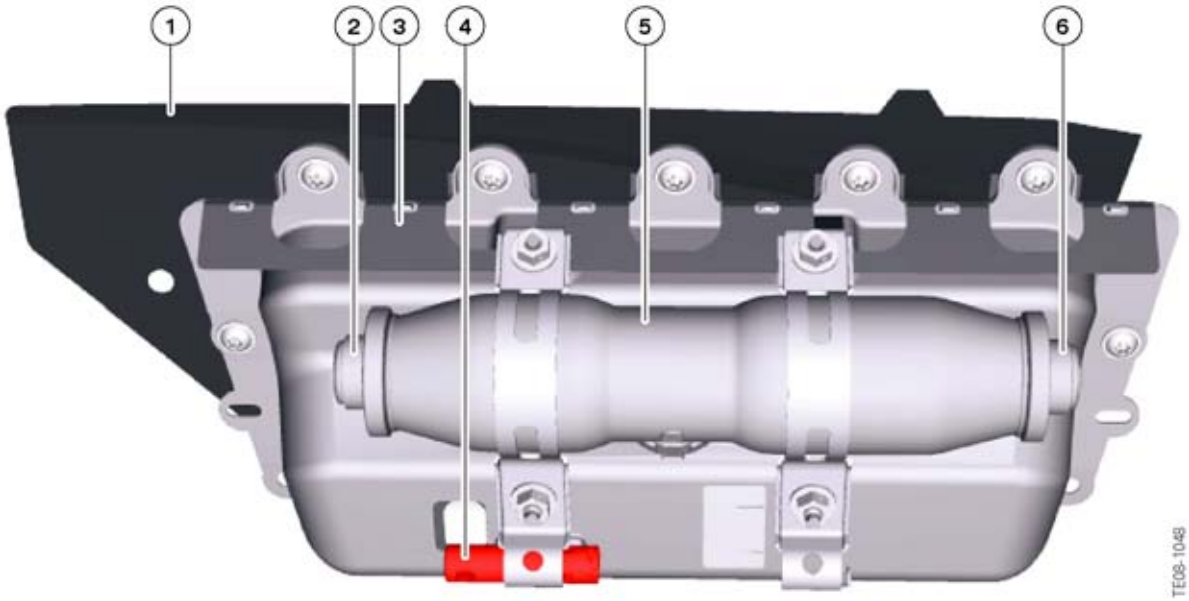
Index	Explanation
1	Connection of the cell for the active vent valve
2	Connection of ignition cell for first stage of driver's airbag
3	Connection of ignition cell for second stage of driver's airbag

The driver's airbag features an active vent valve.

5.3.2. Front passenger airbag

The purpose of the front passenger airbag is to reduce the risk of accident to the front passenger in the event of a head-on collision. The front passenger airbag is located in the dashboard. When the front passenger airbag expands, the dashboard tears open at defined points. The front passenger airbag opens towards the windshield, emerges in the upwards direction and is supported on the windshield and dashboard.

A two-stage generator is installed which can be used to activate the stages at different times, depending on the severity of the crash detected.



F12 Front passenger airbag

Index	Explanation
1	Cover
2	Ignition cell for second stage
3	Housing, airbag
4	Actuator for active vent valve
5	Gas generator
6	First stage ignition cell

The front passenger airbag features the active vent valve.

5.3.3. Knee airbag

The knee airbag is installed on the driver's side and front passenger side to control the forwards displacement of the occupant(s) in the event of a head-on collision.

F12 Knee airbags

Index	Explanation
1	Knee airbag, driver's side
2	Knee airbag, front passenger side

5.3.4. Side head airbag, front

As with all current models, the side head airbag at the front ignites out of the front seat backrest.

The side head airbags and gas generators are accommodated in a plastic housing, referred to as the airbag module. This is installed in the front seat backrest and is disguised by the rear panel.

If activated, the side head airbag emerges outwards between the backrest frame and backrest rear panel and spreads between the side structure and occupant. The volume of the side head airbag has been enlarged to protect the thorax and head of the vehicle occupants.

It is important to ensure that no additional seat covers are fitted as they will greatly impair the function of the side head airbag, or even immobilize it altogether.

F12 Seat with side head airbag

Index	Explanation
1	Side head airbag

F12 Passive Safety Systems

5. System components

5.3.5. Front belt tensioner

Three-point seat belts integrated into the seat have been used as the seat belt systems in the front seats of the F12. The entire seat belt system is integrated into the seat. If the seat backrest is not locked, a Check Control message is displayed when the vehicle is in motion as the seat belts cannot provide a restraining effect if the backrest moves forward in a crash situation.

F12 Seat belt

Index	Explanation
1	Seat belt buckle tensioner
2	Side head airbag
3	Automatic tensioner with adaptive force limiter

Seat belt buckle tensioner

The task of the pyrotechnic seat belt buckle tensioner is to minimize the belt slack in the pelvis and shoulder regions in the event of a collision, thereby improving the restraining effect.

The seat belt buckle tensioners are located at the driver's seat or the front passenger seat. The seat belt buckle tensioners are ignited in specific crash situations.

The seat belt buckle is connected by means of a steel cable to the piston in the tensioning tube. If the ignition cell is triggered, gas pressure is created, which moves the piston in the tensioning tube. This causes the cable to pull the seat belt buckle down and the seat belt is tensioned.

F12 Passive Safety Systems

5. System components

F12 Seat belt buckle tensioner

Index	Explanation
1	Seat belt buckle switch
2	Tensioning tube with piston

Automatic tensioner with adaptive force limiter

An automatic tensioner with adaptive force limiter for the driver and front passenger is installed in the F12. The gas generator-assisted automatic tensioner ensures that the seat belt strap is reeled in to reduce belt slack prior to forwards displacement of the occupants.

The adaptive force limiter switches from a high level force to a low level force with the assistance of a gas generator in order to reduce the retaining force of the seat belt during the impact.

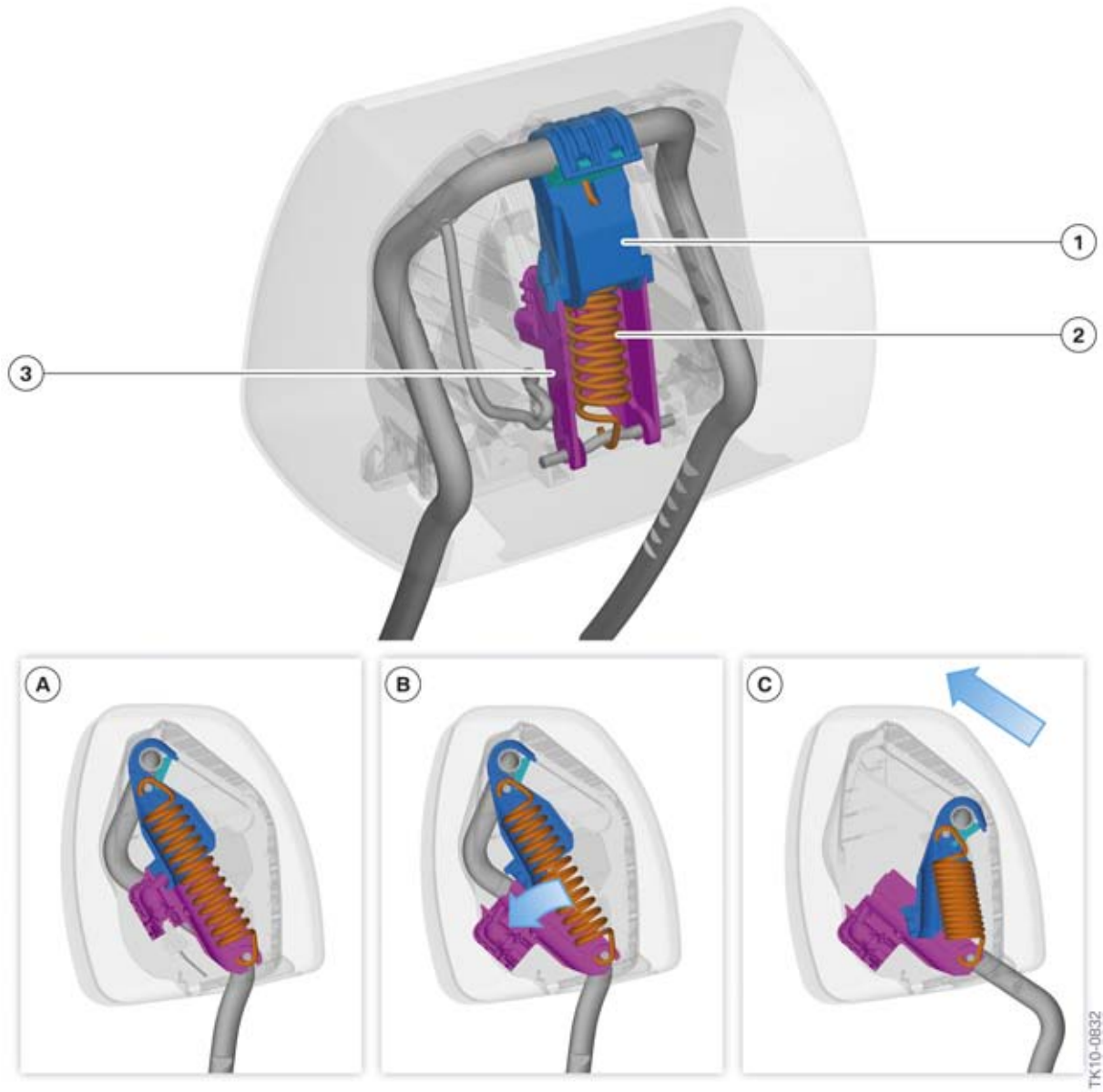
When optimally harmonized with the airbag, it ensures the kinetic energy acting on the occupants is more evenly dissipated for the duration of the crash. Thus lower occupant stress values are achieved.

5.3.6. Crash-active headrests, front

Both front seats are equipped with crash-active headrests. These are head restraints with pyrotechnic actuators, which optimize the distance to the head in the event of a rear-end collision with sufficient severity. This reduces the load on the cervical vertebrae that results from a rear-end collision. The head restraint is activated early, even prior to backwards displacement of the occupant's head.

F12 Passive Safety Systems

5. System components



F12 Crash-active headrests

Index	Explanation
A	Driving position
B	Support activated
C	Crash position
1	Support, upper part
2	Tension spring
3	Support, lower section with pyrotechnics

The crash-active headrest reduces the load in the cervical vertebrae in the event of a rear-end collision. For the vehicle occupants therefore, correct adjustment of the head restraint and the distance of the head from the head restraint is of crucial importance.

In the event of a rear-end collision, the crash-active headrest reduces the distance between the head and the head restraint before the occupants are displaced backwards. This reduces the danger of injury to the cervical vertebrae, even if a minor accident occurs.

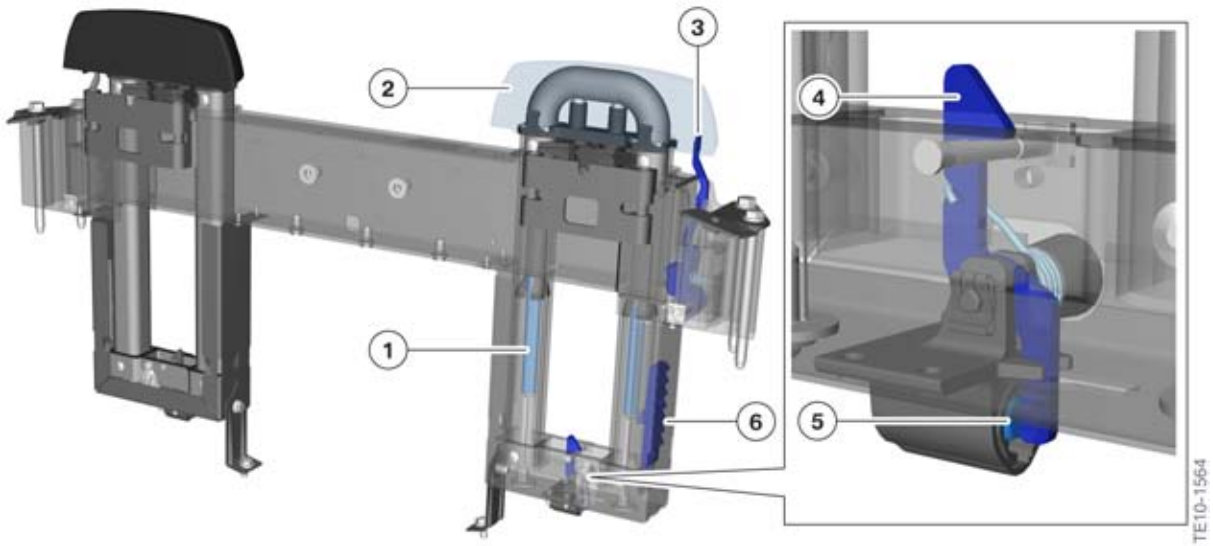
If the crash-active headrests have been triggered, the pyrotechnic actuators must be replaced in the workshop. In this case please always refer to the repair instructions.

Seat or head restraint covers and/or accessories that could impair the protective effect must not be mounted on the head restraints.

5.3.7. Roll-over protection system

The roll-over protection system plays a significant role in the passive safety of a convertible. When the vehicle rolls over, two rollover bars extend and rigidly engage thus increasing together with the reinforced windshield frame the survival space for the vehicle occupants.

If the system is activated, the two pyrotechnic actuators are ignited and the spring-loaded rollover bars are extended. The rollover bars engage in the end position.



F12 Roll-over protection system

Index	Explanation
1	Spring
2	Cover
3	Release lever
4	Lock
5	Ignition cell
6	Lock

Service activation

If the roll-over protection system has to be removed during the course of a repair, the roll-over protection system will have to be mechanically activated beforehand according to the following method.

F12 Service activation of roll-over protection system

Index	Explanation
1	Covers

Danger of injury!

Before activating the system, make sure that nobody is in the immediate vicinity of the rollover bar.

- Open soft top
- Open tailgate
- Take off the covers on the left and right-hand side of the luggage compartment trim panel
- Using a hexagon socket wrench, turn against the compression force until the bar travels upwards.

Reset the roll-over protection system following service activation

- Open soft top
- Pull the release lever out and hold in this position
- Push rollover bar downwards
- Let go of the release lever just before the rollover bar engages
- Push the rollover bar right down until it audibly engages.

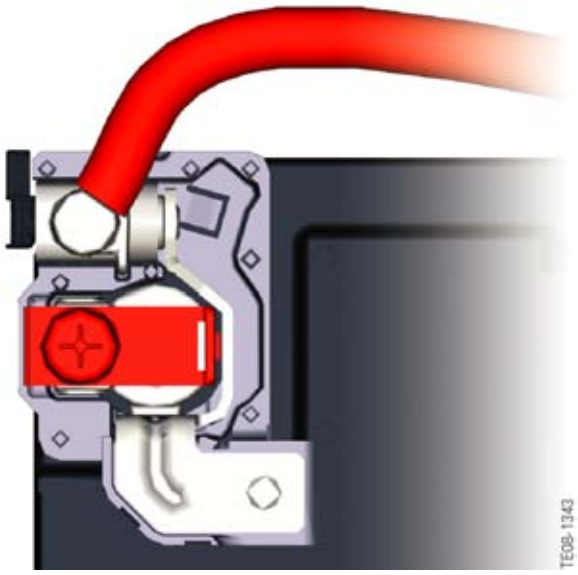
If the roll-over protection system was activated during an accident, the pyrotechnic actuators must be replaced at the workshop. Please strictly observe the repair instructions.

If the roll-over protection system has been activated, it will no longer be possible to reset the roll-over protection bars. Both rollover bars must be pushed down manually in order to open and close the soft top.

5.3.8. Safety battery terminal

The safety battery terminal is triggered at different thresholds when the Crash Safety Module detects a head-on, side or rear-end crash of sufficient severity. The line that connects the battery to the starter motor/alternator and positive battery connection point is then severed by means of pyrotechnics. The safety battery terminal is located directly at the positive terminal of the battery.

Even though the safety battery terminal has been explosively severed, a voltage supply to all safety-relevant consumers such as hazard warning flashers, interior light, airbag and telephone (including emergency call) is ensured.



F12 Safety battery terminal

5.3.9. Airbag indicator light

The airbag indicator light is located on the instrument panel. The airbag indicator light lights up then goes out during the pre-drive check to signal readiness of the Crash Safety Module and passive safety systems. The airbag indicator light is controlled via a message on the PT-CAN from the Crash Safety Module to the instrument panel. The instrument panel receives a message cyclically. If the message remains off, the airbag indicator light is activated.

F12 Airbag indicator light

5.3.10. Seat belt warning light

A visual and audible warning is issued if the seat belt is not fastened or is unbuckled during the journey.

F12 Passive Safety Systems

5. System components

F12 Seat belt warning light

5.3.11. Indicator lamp for front passenger airbag deactivation

The indicator lamp for front passenger airbag deactivation in the F12 is in the roof function center. The indicator lamp for front passenger airbag deactivation is activated if the CIS mat detects a small child in a child seat or if the front passenger seat is unoccupied.

The brightness of the indicator lamp for front passenger airbag deactivation is controlled via the automatic brightness control of the display illumination.

F12 Roof function center with indicator lamp for front passenger airbag deactivation

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